

AWI AMSR2 ice concentration product v110

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Introduction

The AWI AMSR2 ice concentration product is based on previous developments at the University of Bremen (UB) and the University of Hamburg (UHH) [1,2,3,4]. The level 1 brightness temperature data are provided by the Japan Aerospace Exploration Agency's (JAXA) Advanced Microwave Scanning Radiometer 2 (AMSR2) [5].

Main features

- Visually improved ice concentration with lead occurrences
- 3 km resolution
- New landmask
- Twice daily processing with 12 hour window
- GEOTIFF and NetCDF4 format

Product specifications

The product is generated twice daily for two different start times (00 and 12) and includes orbits from 12 hours. The file name indicates the start and end date (YYYYMMDDhh) and time, the latter date without the year. The mean times as given in the resulting product are 06:00 and 18:00, respectively.

After 12 hours the spatial coverage is about 90%. The remaining data gaps are filled with older data from the previous 12 hour time slice.

The benefit of twice-daily processing and the 12-hour window is a reduced latency compared to daily averages. Artifacts by fast-moving sea ice (doubled structures) are also reduced.

There are different products with the filename including SIC, SIC_LEAD and SIC-LEADS. The first is the traditional ASI ice concentration, the second contains the lead ice fraction [4], and the latter product contains the ice concentration minus a percentage of the lead fraction. Furthermore, the product is generated with and without landmask and geo-coordinates.

Filename convention

hemis_product_start_end.dataformat(.gz)

SIC_LEAD

Includes sea ice concentration, lead ice fraction, land mask and geo-coordinates in NetCDF4 format.

SIC wo latlon

Includes sea ice concentration with land mask but without geo-coordinates in NetCDF4 format.

SIC wo mask

Same as above but without land masked.

SIC-LEADS

Lead fraction subtracted from ice concentration in GEOTIFF format.

```
sicleads=(sic-0.2*lead).clip(0,100)
```

This product uses a landmask including lakes and larger water bodies (see below).

Known issues

The products have errors due to weather effects in particular along the coastlines and the marginal ice zone.

The AMSR lead detection does not provide reasonable features during the melting period but is calculated anyhow throughout the year.

Landmask

Landmasks are derived from <https://osmdata.openstreetmap.de/data/>

An obvious difference to previous (UB and UHH) products is a correct representation of northeast Greenland, e.g. the Danmark Fjord, which was wrong in the previous landmask derived from The Global Self-consistent, Hierarchical, High-resolution Geography Database (GSHHG).

An experimental land mask (to be further improved and validated) including lakes and larger water bodies derived from 89 GHz channels is provided with the SIC-LEADS product. The SIC product includes the OSM land mask without these features.

Regional sea ice extent and area

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Regional sea ice extent and area are calculated based on the new NSIDC regional mask for Arctic sea ice trends and climatologies [10]. For the southern hemisphere we follow the regional definition as used in Parkinson and Cavalieri (2012).

AMSR2 extent and area data are updated regularly and stored in the .csv file on the ftp-server: ftp://ftp.awi.de/sea_ice/product/amsr2/v110/analysis/

```
nh_awi_amr2_regional_extent_area.csv
sh_awi_amr2_regional_extent_area.csv
nh_awi_amr2_regional_extent_area_median.csv
sh_awi_amr2_regional_extent_area_median.csv
nh_awi_uhh_ifremer_SSMI_regional_extent_area_median_1992_2020.csv
sh_awi_uhh_ifremer_SSMI_regional_extent_area_median_1992_2020.csv
```

The specification *median* indicates a median-filtered version of the data. For AMSR2 we use a three-day window which means six 12h products. The 50th percentile (median) is calculated for each pixel from this three-day window. For SSMI a 5-day window has been used [8]. The median filter effectively removes weather noise effects. However, some real drifting ice could also be removed which could cause a bias.

The sea ice extent and area data are not yet "calibrated". Biases may exist due to coastal/land pixels that show false positive ice occurrence.

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Regional sea ice extent and area are calculated based on the upsampled 25 km "NSIDC" regional mask "Arctic_region_mask_Meier_AnnGlaciol2007.msk" available at <https://nsidc.org/data/g02135> [7]. Extent and area data are updated regularly and stored in the .csv file on the ftp-server: ftp://ftp.awi.de/sea_ice/product/amsr2/v106/analysis_nh/nh_awi_amr2_regional_extent_area.csv

For comparison the same procedure was applied to the ASI 12.5 km SSMIS 5-day median filtered as provided by UHH [8]. The result is stored in the file `nh_extent_SSMI_ASI_Regional_1992_2020.csv` on the ftp-server.

Data formats

NetCDF and GeoTIFF.

NetCDF includes latitude and longitude grids and landmasks INT16 scaled by 0.01f

Projection and grid

<https://epsg.io/3411> NSIDC Sea Ice Polar Stereographic North <https://epsg.io/3412> NSIDC Sea Ice Polar Stereographic South Grid cell size 3125 meter

Data distribution

For free without warranty through ftp://ftp.awi.de/sea_ice/product/amsr2/

Acknowledgement

Thanks to X. Tian-Kunze for deriving AMSR2 lead fraction parameters (BMBF CATS project) [9].

References:

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[3] Beitsch, A.; Kaleschke, L.; Kern, S. Investigating High-Resolution AMSR2 Sea Ice Concentrations during the February 2013 Fracture Event in the Beaufort Sea. Remote Sens. 2014, 6, 3841-3856. <https://doi.org/10.3390/rs6053841>

[4] Röhrs, J. and Kaleschke, L.: An algorithm to detect sea ice leads by using AMSR-E passive microwave imagery, The Cryosphere, 6, 343-352, <https://doi.org/10.5194/tc-6-343-2012>, 2012.

[5] <https://gportal.jaxa.jp/gpr/>

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[8] <https://www.cen.uni-hamburg.de/en/icdc/data/cryosphere/seaiceconcentration-asi-ssmi.html>

[9] Das arktische transpolare System im Wandel : deutsch-russische Zusammenarbeit in der Polar- und Meeresforschung : Abschlussbericht :

Sekretariat : »System Laptewsee« (Deutsch) - Arbeitspaket 2:
Veränderungen des Systems Atmosphäre/Meereis/Ozean und ihr Einfluss auf
das transpolare System, Zielsetzung B: Monitoring von
Meereiseigenschaften und Meereisproduktion <https://doi.org/10.2314/KXP:1755642571>

[10] J. Scott Stewart and Walter N. Meier, Regional mask for Arctic sea ice trends and climatologies (version 2021), NSIDC, https://insidecires.colorado.edu/rendezvous/uploads/Rendezvous20211448_1619668996.pdf

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Changelog

v110 2022-08-29 v110 Calculation of northern and southern hemisphere regional extents, also with 3 day median filter.

v110 2022-07-19 v110 reprocessing. To be updated: calculation of regional extents.

v110 2022-07-06 Parallelized code for fast reprocessing; Improved netCDF encoding; Orbit product; New NSDC regional mask; Changed README format to markdown (pdf)

v106 2021-08-04 Reprocessed MOSAiC period published on ftp site.

v106 2021-07-29 Repaired land mask at east Greenland coast. Included sea ice - leads product. Started first reprocessing, August and September, and MOSAiC period.

v105 2021-07-27 Update to Ubuntu-20 and code cleanup, no intentionally change of product. Further testing.

v104 2021-03-26 Generate merged global GeoTiff to be used e.g. with Google Earth

v104 2021-03-23 Bug fixed: removal of incomplete orbits caused data gaps in Pacific sector.

v104 2021-03-20 Included lakes and larger water bodies over land derived from 89 GHz brightness temperature (to be validated). Isolated structures < 4 pixels removed.

v104 2021-03-20 Replaced ocean mask with hand-picked ocean mask (to be validated). This should help against artificial boundaries. Thanks to Uniquorn ASIF post Re: Home brew AMSR2 extent & area calculation Reply #3571 on: December 05, 2020, 12:43:56 PM

v104 2021-03-16 Corrected for the day in file name. Added date information text in GeoTiff and PNG.